Oxyanion Adsorption And Competition: A Synchrotron Far Infrared Spectroscopy Study

C. Melendres (Argonne Nat. Lab.), F. Hahn (U. Poitiers, France) and G. Bowmaker (U. Auckland, N.Z.)

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Summary: Synchrotron Far Infrared Reflectance Spectroscopy (SFIRS) has been used to study the adsorption of oxyanions at a gold thin-film electrode.

Results: Surface-adsorbate vibrational frequencies of 240 and 255 cm^{-1} have been measured "in-situ" in acid solutions of 0.5 M $HClO_4$ containing 0.05 M Na_2SO_4, and Na_3PO_4 respectively. It was observed that in the presence of Br^-, competitive adsorption occurs such that phosphate is displaced from the electrode surface and the current-potential behavior of the electrode is determined by the more strongly adsorbed Br^- anion. In 0.1 M $NaClO_4$ at neutral pH, no interaction between the oxyanions and the gold surface could be observed and the intensity of the Au-Cl^- vibration was about five times weaker than in acid. Adsorption of OH^- was found to be the dominant interaction, inhibiting sulfate adsorption, in 0.05 M Na_2SO_4 + 0.1 M $NaClO_4$ solution. The latter finding is similar to results obtained by others on the inhibition of sulfate adsorption on silver by OH^-.

Conclusions: SFIRS is a powerful technique for the study of the behavior of adsorbed species at the electrode/electrolyte interface.

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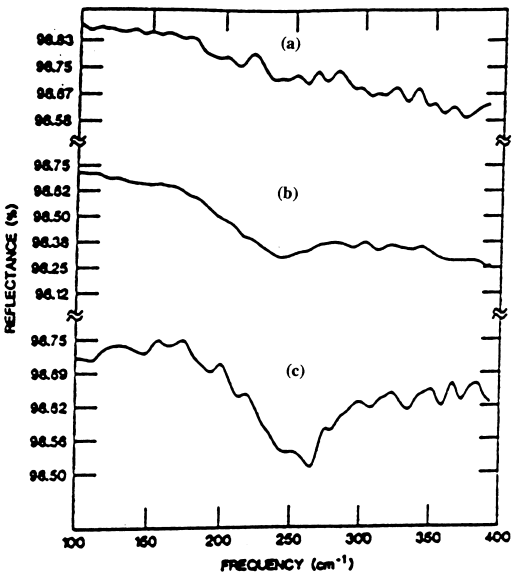

Figure 1. "In-situ" synchrotron far IR reflectance spectra of a gold thin film electrode in 0.5 M $HClO_4$ + (a) 0.05 M KNO_3, (b) 0.05 M Na_2SO_4, and (c) 0.05 M Na_3PO_4